Financial Feasibility of Building and Operating a Fiber Network in the City of Seattle

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Executive Summary

CCG Consulting, LLC was hired to undertake a financial feasibility study of the various options of building and operating a fiber network throughout the City of Seattle. In order to create the needed financial studies, CCG undertook several tasks:

- Investigation of market rates
- A survey to understand residential demand
- An engineering study to understand the cost of building a fiber network
- An analysis of other costs of providing service and operating a network.

CCG looked at two different operational models: a retail network where one party would build the network and provide retail services, and a wholesale network, in which the City would build the network and multiple other service providers would sell retail services to customers.

The report below explains the process used to create the studies and lists the key assumptions we made for prices, costs and customer penetration rates.

Some key findings of our study:

- A single retail provider could be successful in Seattle. Such a provider could finance, build and operate a fiber network profitably. If the City or a non-profit company were the retail provider they could give a 20% discount over today's market prices and still break even with as little as a 24% market penetration. A commercial firm would probably need a 30% penetration to be successful. Higher penetration rates would generate significantly higher profits and more cash.
- The City could be successful with a wholesale model. In this model the City would build the network and sell access to the network to large service providers. A wholesale model would achieve breakeven for the City at around a 30% market penetration of retail customers. However, it is essential that the retailers sell significant numbers of customers in the first few years or the wholesale business would run out of cash. Thus, the wholesale model carries a large amount of risk if not done right.
- There is much promise in a hybrid model. Under this concept, the City or a non-profit business would build the network, likely with bond financing, and would be the only retail provider for five to seven years until the network had enough customers to ensure the ability to repay the bonds. At that point, the network would be opened to multiple competitive service providers who would bring innovation and additional competition.
- The cost of creating a wholesale or retail business to the entire city will require financing of over $400M. It costs nearly as much to create a wholesale business as it does a retail business.
- Over 60% of Seattle households in our market survey said they would buy telephone, cable TV and/or data services from a City-sponsored fiber network if it offered lower prices.

CCG makes the following recommendations.

First, the best outcome for the City would be if a commercial retail provider made the investment to build the fiber network and offered a full array of services over the network. Although no such player emerged during the RFI process, now that we have the market survey and financial results that can be shared with providers a second attempt might well yield different results. The City should consider issuing an RFP that would include the results of the financial analysis and market survey. These analyses show that a commercial provider could make an acceptable profit in the City.

Second, a retail model where the City is the retail provider looks to be the best way to guarantee that there will be sufficient revenues generated to make bond payments. However, an open access wholesale network looks to be the best long-run network for the City since multiple service providers will maximize innovation and competition. Thus, CCG recommends the hybrid approach in which the City builds the fiber network, and then the City or some corporation is granted the exclusive right to operate the network for a period of five to seven years until such time that the network has sufficient revenues to guarantee bond payments. At this point the network should be opened up to multiple providers as an open access network. The initial service provider would continue to for customers, but with a host of new retail providers.

Today there are no strong retail players ready to step in and serve customers on the fiber network. If the City were to start a wholesale model with the wrong retail partners it could be a financial disaster. There is very little cost for a retail provider to walk away from the network, but the City must make bond payments, even under a standalone financing, or face a lot of political pressure. In a hybrid model, however, if the City stays in the business as a retail provider, it can still pursue the various social goals such as economic development and solving the digital divide. Any commercial network is unlikely to seriously pursue these sorts of goals.

Recapping our study, CCG believes that the hybrid model maximizes benefits to the City, its residents, businesses and institutions. Under the hybrid model, the City could obtain sufficient profits to ensure retiring its debt, and over time provide an open network that can further stimulate innovation and competition.

Third, to the extent that bonds are used to finance this project, the use of revenue bonds would drastically reduce any financial risk for the City. Revenue bonds would pledge only the revenues from the fiber network to the bond, with no additional backing of other City revenues or tax revenues. We should also note that the interest rate on revenue bonds today could be obtained in the range of 4.7%, which is lower than the interest rate of 5.2% used in the feasibility study. In addition, the spread between revenue bonds and general obligation bonds is currently as close as it's been in memorable history.

Purpose of Feasibility Study

The financial feasibility was undertaken for several reasons. First, it was important to more closely define the cost of the physical fiber network. During the RFI process the City heard widely differing estimates of the cost of building the network.

Second, the study was undertaken in order to understand the financial feasibility of various operating models with a focus primarily upon a retail and wholesale network. A retail model is one where one primary provider would build and operate the network as the sole provider. An example of a retail network would be the Verizon FiOS network. A wholesale network is one where the City would build the network and then lease capacity to multiple retail providers on the network.

Understanding profitability of these two options is essential to understanding the potential for getting a network built in Seattle. If a commercial provider is to build and operate a network in Seattle they will have specific profitability goals that must be met. If the City is to operate the fiber network you also would want profitability, but the City defines profitability differently than commercial entities. A City generally defines profitability as the ability to make bond payments, support future capital requirements and retain enough cash to be self-supporting. The feasibility report helps us look at these two different definitions of profitability.

Methodology

CCG Consulting undertook the feasibility study in the following manner.

CCG performed a high-level engineering study to determine the cost of building a fiber network in Seattle. CCG's engineer visited Seattle in December, 2006, and met with both City and City Light employees. Since the City has already built a significant amount of fiber the goal was to rely on the actual cost experience of the City in building fiber. From the City we were able to determine current market construction costs for various types of fiber, both aerial and underground. Additionally, the CCG engineer undertook a network design that will be described in more detail below.

CCG's engineer worked with the City to understand the physical needs of the network, including quantifying the number of miles of fiber that needed to be constructed. Further, the City already had a very good estimate of how much existing utilities lines in the City use underground versus aerial cable on poles.

CCG also worked with the City to help quantify the number of households and businesses in the City today, along with the expected growth rate for the future.

CCG undertook an analysis of current market prices for telecommunications services, studying the prices charged today by the incumbents, Qwest and Comcast. We also looked at prices for several CLECs (Competitive Local Exchange Carriers) who offer

competitive voice products in the market. A small portion of Seattle is served by a second cable company, Millenium, but prices in the study are based upon Comcast prices, since they are the dominant CATV provider.

CCG then made estimates of costs based upon our experience with over 350 communications entities that operate voice, broadband or cable TV businesses and hundreds of financial business plans. We used this experience to estimate the operating costs for the study. These assumptions are described in more detail below.

Network Costs

Following his visit to Seattle in December, 2006, Derrel Duplechin, the CCG Vice President of Engineering, undertook a high-level engineering study to estimate the cost of building a fiber network in the City. The study is considered high-level since it relies on market estimations and metrics in order to estimate the cost of the network. For example, an estimate was made of total number of route miles to be constructed and total construction cost was then determined by multiplying the estimated miles times current construction costs.

If Seattle proceeds to construct such a network, one of the first steps will be to perform detailed engineering in which engineers would walk every street to determine exact construction parameters and exact quantities of required fiber. However, such detailed engineering is time-consuming and very expensive and generally is not done until there is a financial commitment to build the network. In CCG's experience, high-level engineering allows for a reasonable estimate of construction costs, and if assumptions are kept conservative, a high-level estimate should be on the high side.

Working with the City

CCG met with employees of the City and City Light to discuss the characteristics of building fiber in the City. Both entities have constructed significant fiber and have experience with local contractors and experience with local Seattle construction conditions. The primary focus of the CCG meetings was to determine the number of street miles needing various types of construction (aerial versus underground), and current constructions costs in the City. Construction costs vary widely by geography and local conditions and the cost to build a fiber in Seattle might be very different than the cost of building in other similar cities. Thus, it was essential to understand actual recent fiber construction projects undertaken by the City.

Basic Network Design

After investigating construction costs, the next step was to develop a basic network design. CCG decided to design the network as a Passive Optical Network (PON), rather than one other technological option referred to as an Active Optical Network (AON). CCG chose a PON network because it is the primary type of municipal network being

designed today. However, from a cost perspective, both types of networks have similar costs, so our estimate could be used interchangeably for both technologies. It is not necessary to select the specific type of electronics at this early in the process.

CCG determined that the most logical way to design the network is to subdivide the City into sectors. Currently City Light has divided the electric network into eleven sectors called substations, and we decided to use the existing electric substations as the basis for designing the fiber network. This design concept has proved popular in other cities, because the existing pole and conduit systems generally originate and propagate from the substations, thus making them a natural place to start building a fiber network. However, if detailed engineering is to be performed, it might be even more cost effective with a fewer sectors.

In each sector the network would begin with a hub site that consists of a small building that houses electronics and terminates the fiber. Fiber would initiate at each of these hub sites and would follow the existing utility practices throughout the City – underground where other utilities are underground, and on poles where existing utilities are on poles. It would be convenient if the hub sites could be located with the existing electric substations. These locations already have security and backup power. However, if that can't be worked out, the hub sites could be located somewhere near the electric substations.

In addition to the eleven hub sites, the network would have one core hub where key electronics would be housed. This hub is referred to in a network as the headend and could be anywhere in the City along the primary fiber route. In the retail model the headend would house the equipment needed to provide voice, video and data. In the wholesale model it would be the point of interface between the retail providers and the wholesale network operator.

The eleven hub sites and the headend would be connected by a two-way fiber ring. Such a ring architecture insures that no hub can be isolated if there is a fiber cut. Today City Light maintains a fiber ring that already connects the substations. After meeting with City Light it was determined that the core ring for the fiber network could probably be leased from City Light, eliminating a need for new construction of the core network. The fiber network probably needs no more than 6 or 8 fiber pairs on the existing core fiber ring, so existing capacity is not an issue.

In a PON network, all key active electronics are housed in a location referred to as a headend. The hub sites contain electronics used to light the core ring and also would contain splitters. Splitters, physical devices that allow one fiber pair to be subdivided to feed multiple fibers, are the key design mechanism in a PON network that enables having a fiber for every home and business in town.

Feeder fibers would be constructed into neighborhoods starting at the eleven hub sites and would be used to carry the signal deep into each neighborhood. Each feeder fiber can serve between 16 and 32 homes or businesses, depending upon the vendor selected.

The CCG network design created enough feeder fibers to be able to serve every home and business in the City. A more conservative design might have assumed a 50% take rate of customers and only designed a fiber for half of the homes and businesses.

Customers are served from the feeder fibers by the use of fiber drop wires and fiber electronics installed for each customer. Fiber drops would follow existing utility practices and would be aerial where other utilities use aerial drops and underground where other utilities use underground drops. The electronics at each customer is referred to as an ONT (Optical Network Terminal), which is housed in a small box that is usually put on the outside of each customer location. There are different types of ONTs depending upon the type of customer: the smallest ONT is designed to serve residential customers and small businesses, while larger ONTs are designed to serve MDUs (Multi-dwelling units) and large businesses.

The network was further designed to use connectorized drops. This is a construction method whereby devices called multi-ports are installed on poles or in pedestals. With connectorized drops the drop wire is pre-configured with a plug on each so that it can be plugged into the multi-port and plugged into the customer ONT. This construction methodology saves time and costs since the installers don't need to splice every time they install a new customer.

Seattle has one interesting geographical feature that allows for a very efficient fiber feeder network design. In the majority of the City the blocks are long in the north-south direction and short in the east-west direction. There are exceptions, but this basic characteristic covers most of the City. CCG determined that it was only necessary to design feeder fiber for the north-south streets as the east-west blocks are short enough that customers on those streets could be reached with a drop wire. Using this technique saved significant construction costs since a feeder network is not constructed on the short ends of the blocks.

Major Design Assumptions

Following are some specific network design assumptions made by CCG:

Network

- Used 11 hub sites based upon the layout of the existing electric substations. We added a twelfth hub site for the headend to develop a design that equates to roughly 30,000 homes and businesses per hub site.
- Used the existing City fiber ring for the core network that would connect the hubs.
- Used all new construction for the feeder fibers to neighborhoods.
- Followed existing electric cable miles for determining required fiber construction. Today's electric network consists of 1,282 miles of aerial cable on poles, 370 miles of buried cable, and 69 miles of cable underground in conduits.

- Designed feeder fibers to run north/south for most of the city and will use fiber drops to serve the east/west customers.
- The network will be built everywhere in the City. However, the large businesses downtown will not be an initial priority for the network because these buildings already have fiber or can easily get fiber today. When the network is built downtown we assume it will use the existing City Light conduits to get access to buildings.

Customer Distribution

- Used connectorized drops. This allows for customer drop wires to be plugged in instead of spliced, saving cost and time.
- Buried drops are used where other utilities bury drops today and aerial drops are used where other utilities use aerial drops today.
- Assumed every customer would get an individual ONT. This results in a high estimate of costs since there are many situations where customers can share an ONT. For example, the cost per ONT is lower for apartments where multiple customers can share an ONT. Also, many small businesses can use residential ONTs, which cost less, but the model assumes all businesses will use more expensive business ONTs.
- Average drop length is estimated at 170 feet. Most homes in Seattle are relatively close to the street and the estimated footage accounts for service normal homes and businesses as well as customers living on east/west streets.
- ONTs are powered with the customer's power and will be equipped with battery backup in case of a power failure.
- Deliver of bandwidth inside the house will be done using technologies that use either the existing cable wiring or the existing electric wiring. Cable service would use existing cable wiring. Telephone service would be provided using existing telephone wiring. Some small percentage of customers will need new wiring if they aren't wired today for telephone or cable.
- Customers who buy the equivalent of today's analog TV (60 channels) will not require settop boxes but every digital customer gets a settop box. This is a conservatively high estimate since the industry is migrating towards including the settop box electronics in new TVs. Over time many customers will opt out of using the retail provider's settop box.

Major Cost Assumptions

Following are some of the cost assumptions used in the engineering estimate:

- Used $10.90 per foot for aerial fiber construction.
- Used $20.40 per foot for buried fiber.
- Used $20 per major fiber splice (48 to 72 splices).
- Cost to bore a 2-inch conduit is $14 per foot.

- Average cost for an aerial residential drop is $292
- Average cost for a buried residential drop is $615
- Average cost for an aerial business drop is $1,255.
- Average cost for a buried business drop is $1,504
- Initial cost for an installed residential ONT is $613. The assumption is that this will decrease in price over time.
- Initial cost for a business ONT is $2,468. The assumption is that this will decrease in price over time.
- Note that the cost of loops and ONTs is success driven, that is these costs are only incurred when customers are connected to the network. More customers means more capital.
- A major cost component of building in Seattle is the sales tax of 8.8% that is charged for most of the network. This makes the network more expensive than in other jurisdictions.

City Assets Required

The assumption of our model is that some City assets ought to be made available to the network, regardless of the ultimate operator. To the extent required by law, such assets would be leased at going market rates. Some of the City assets that could contribute to the network:

- Six to eight fiber pairs on the existing City Light core fiber ring.
- Use of land at the existing electric substations or use of other City land in adjacent neighborhoods if available.
- Use of existing City Light conduits where available.
- Use of existing City Light building entrances downtown if the network is extended to the large downtown buildings.
- Potentially the use of an existing City building to house network employees and the headend.

The Retail Model

The first business plan studied by CCG was a retail business plan. Retail in this case means that the network operator would both build the network and sell retail services to customers. The retail provider could be some commercial entity, like Verizon, or it could be some entity created by the City. Business plan options will be discussed below.

The retail option was studied for several reasons. First, it is important to understand retail profitability in the market. Every market is different and one can't understand the potential for profitability without looking in detail at local prices and local costs. The retail model was developed to show how a standalone operator might operate. Large companies that already operate large networks elsewhere would probably have an economy of scale and could be even more profitable than shown in the model.

Understanding profitability lets us understand the potential for either attracting a major network operator to Seattle or justifying the City's entry into the business.

The retail model also lets us understand the amount of cash that can be generated by a fiber business in the City. Understanding cash is essential if we are to evaluate wholesale options, because in a wholesale environment there must be sufficient cash for both the retailers and for the network owner.

The analysis of the retail model shows that there is the potential for significant profitability from bringing a modern fiber network to the City. If we were to bring a commercial entity or create a new entity to provide these services, such a business could provide tremendous benefits to the City while also being profitable.

Services Provided

The model assumes that a retail provider in the City would utilize the fiber network to provide a full array of products to consumers as follows:

Residential Customers

The model assumes that the retail provider would offer the full triple play of voice, video and data to residential customers. The key assumption in the model is that the retail provider would offer a 20% discount compared to today's prices, for all services provided. Such savings would be a tremendous boon to the local economy and would inject around $2 Billion into the local economy over 20 years.

Other cities in the fiber business have enhanced services compared to the incumbents. For example, a typical city provider will offer more channels of cable programming than the incumbent, and for a lower price. City telephone products typically include a number of features included in the base rate for which telephone companies charge extra. City data speeds and products would be far faster than the incumbent products.

The network provider would be expected to offer all of the bells and whistles available by other competitors. In cable TV today that would include such things as Video-on-Demand, DVR, HDTV and other such advanced features. The network provider would also be expected to remain current with future developments and introduce new products as available.

The most immediate and largest long-term benefit to residential households would be from greatly enhanced data speeds to the Internet. As an example, today, in cities they serve, Verizon offers fiber residential download speeds of 5 Mbps, 15 Mbps and 30 Mbps. A fiber network, however, is capable, with today's technology, of even greater speed. In Provo, Utah, a municipally provided system, customers today have peer-to-peer capability, within the City network of

100 Mbps. Offering the fastest speeds possible would revolutionize the City and would allow for Seattleites to take full advantage of and create new technologies. A fiber network would bring Seattle into the forefront in world competitiveness.

Small Business Customers

The small business market is generally hungry for competition. The retail provider would bring the triple play to small businesses, although many businesses would only be interested in voice and data services. Today there are many providers offering services to large businesses and to the downtown high rises, but competition typically bypasses small businesses. The retail model also envisions a 20% price discount for this market. The largest benefit to the small business market would be increased data speeds. Seattle businesses would have a leg up over other communities because of cheaper and faster data, and would be competitive with nearby communities soon to be served by Verizon's FiOS system.

Large Business Customers

There is already significant competition for large businesses in Seattle and the downtown high rises, which already have fiber or easy access to fiber. Because large companies have complex needs that require complex solutions, CCG always recommends that if a city gets into the network business that they do not try to compete head-to-head for the largest businesses in town. The complex needs of large businesses are best handled by specialized competitors who work only in this market niche.

The biggest benefit of a citywide fiber network would be an overall decrease in town of data prices. The retail model anticipates that large data circuits would be made available to large businesses. While today that would mean 10 Mbps and 100 Mbps connections, in the future that would mean 1 Gbps connections. The network operator ought to sell these products either directly to the large businesses or to those carriers that serve these businesses such as CLECs and ISPs. The retail model assumes prices of $400 per month for a 10 Mbps connection and $1,400 per month for a 100 Mbps connection. These prices are far cheaper than what is available today and would bring tremendous benefit to the City's large businesses and the Seattle economy as a whole.

The City

During the RFI process many of the respondents stressed that they thought it was key for the City to become an anchor tenant of the new fiber network. . The financial analysis shows that though not essential, it is still something the City ought to do in order to promote a fiber network.

Moreover, the City would benefit tremendously from a fiber network. Every City location would be brought onto the high-speed network and every school and library could have affordable 100 Mbps connections. The model assumes a 20% discount for the City services, like that received by other customers.

Note that if the City gets into the retail business, the City gets nearly free communications service. This is one of the major benefits of a City network. If the City were the retail provider, it would still bill itself for services, but since the revenues would stay within the City and the true cost of City services would be small incremental cost of providing service.

Market Share

As part of the study we performed a statistically valid market survey of residential customers. The results of the survey have a 95% reliability, plus or minus 5%, the same reliability level for most business and political surveys. The purpose of this survey was to estimate the market acceptance of a fiber network and of City involvement in such a network. The survey showed that there is tremendous demand among Seattle residents for cheaper and faster TV, data products and other communications services.

Detailed results of the survey are included in a separate report (see att). The highlights of the report are shown from the results of a key question, which is how many households would subscribe to services if provided on a City fiber network. The responses were as follows:

	Yes	No	Maybe
Basic CATV	66%	23%	11%
Digital CATV	54%	33%	13%
Local Phone Service	69%	14%	17%
Telephone Features	68%	16%	16%
Long Distance	63%	21%	16%
High Speed Internet	61%	24%	14%

CCG has performed a large number of surveys nationwide for both municipalities and for commercial firms. The results of the Seattle survey are very positive and are higher than the results seen in many other surveys we have conducted. We guess that the high positive response is a result of a combination of some underlying dissatisfaction with the current providers and/or a very positive feeling about the City.

These positive responses indicate a much larger potential for residences to purchase service from a City network than was predicted in any of the financial models used to look at the potential for profitability for a City network. Every business plan we looked at would be improved with a higher customer penetration rate.

It is our experience at CCG that the questions asked in this survey are a good indicator of how customers will respond in the real market place. We have been doing these surveys for many years for both cities and commercial providers and we have been able to see

how the networks then fare in the real marketplace. Typically, the responses to the market survey track closely with actual market penetration. Therefore, what the survey really tells us is that the households in Seattle will be expected to respond extremely well to a competitive provider of the triple play services, assuming that provider offers lower rates and provides good customer service. We note, however, that achieving the kind of success predicted by the survey will require a sound business plan. Specifically, in addition to lower prices, customers will change service providers if they perceive the new provider to have good customer service and superior performance and reliability.

We did not survey business customers as our experience shows that business surveys are not an accurate predictor of business behavior in the real marketplace. This disconnect between what businesses say on surveys and what they do in real life is due to several factors. First, it's very hard to get businesses to take a survey, and when they do take surveys, it's very difficult to find and interview the real decision maker in a company. Finally, a business's decision on buying telecom products is a complex one and until faced with a real competitive option, a business generally does know how they will respond.

Our retail study looked at two arbitrary market penetration rates, as measured by residential Cable TV penetration. - 30% and 40% market penetrations. Looking at different penetration rates makes it possible to understand those variables that are most important to the success of such a venture. It's comforting to know that the market survey suggests a much higher penetration rate.

Understanding the potential for business penetration rates is more complex than for residential. For most businesses, price is not the primary reason to change providers. Businesses rely on their telephone and data connections to conduct their business, so they value network reliability more than price. In our experience, businesses are slow to accept a new network, but over time, if they see it is reliable, businesses will eventually migrate to a new network. The study uses a sales-driven approach to achieve sales to small businesses. We have found that the only way to sell to businesses is to knock on their door, so the model projects salespeople who visit and sell to small businesses. In our experience, a sales force with a superior product will always succeed, and in this case the product should be both price competitive and technologically superior to the competition.

One of the key variables in the study is the speed with which the retail service provider gains new customers. The study shows that it is essential to get customers quickly if the business is to be able to support debt. One of the key aspects of building a fiber network is that there is a significant capital cost expended for each customer added to the network. These costs represent roughly half the capital costs of building a network with the remaining capital spent to add fiber drops and ONTs at the customer premises. The business does best if it adds customers quickly, thus generating some of the cash needed to pay for the capital.

There are a number of ways that a new network could get customers quickly. Other cities have used sign-up lists during the construction period so that a large numbers of customers are pre-sold even before service is available. The retail model assumes that 2,000 customer per month can be added to the new fiber network. This speed is achievable, but will require significant marketing and an efficient organization on behalf of the new company.

We finally note that the retail model predicts that the first retail customer would be installed 18 months after the financing is obtained for the project. This 18-month period would be used for engineering, construction and creation of the retail provider's back office. We have seen a few networks beat the 18-month time frame, but it is a pretty typical time lapse between financing and delivering service.

Revenues

Revenues in the retail model are very straightforward: for the most part the revenues are the product of customers buying retail services.

Sales and marketing are different for each market. The best initial marketing plan for households would start by widely announcing the plans to launch the fiber network and starting a sign-up list during the construction period. The early adopters will be excited about the data speeds and many households will be excited about the savings. Most other cities that use sign-up lists have gotten 20% or more of the market with almost no marketing costs. Subsequent marketing to residents will be done in the traditional ways – doorknockers, mailings and phone calls, while sales to small businesses will be done strictly with salespeople making personal contact. The experience of the various CLECs is that very few businesses will sign up for a network without talking to somebody live. Businesses are also going to be a little slow in accepting a new network provider. Many businesses wait a few years to make sure the new network is stable and reliable.

Residential rates in the retail model are 20% lower than today's prices. Data products would offer vastly superior bandwidth also for lower rates. Following is a sample of residential telephone and CATV rates used in the retail model. Obviously, final rates would not be set until the business launched. These data rates are illustrative, but achievable.

	New Price	Existing Price
Single Line Telephone	$14.67	$18.34
Basic Cable	$ 9.84	$12.30
Basic and Analog Cable	$39.40	$49.25
Digital Cable	$49.58	$61.98

Following is a comparison of the exiting data products available in the City and the products proposed by the study:

Existing Data Products

Comcast cable modem for CATV customer. 6 Mbps down, 384k up	$42.95
Comcast cable modem for CATV customer. 8 Mbps down, 768k up	$52.95
Qwest Choice Deluxe DSL. 1.5 mbps down, 896k up	$39.99
Qwest Choice Premier DSL. 7 Mbps down, 896k up	$49.99

Proposed New Data Products

10 Mbps symmetrical	$39.99
20 Mbps symmetrical	$49.99
50 Mbps symmetrical	$99.99

Small businesses also would get 20% discounts compared to today's market prices and, in addition data products would offer vastly superior bandwidth for lower rates. Following is a sample of small business rates used in the retail model. Obviously final rates would not be set until the business launched. These data rates are illustrative, but achievable.

	New Price	Existing Price
Single Line Telephone	$ 26.18	$32.73
PBX Trunk	$ 26.58	$33.23

Existing Data Products

Comcast cable modem. 6 Mbps down, 768k up	$ 95.00
Comcast cable modem. 8 Mbps down, 1 Mbps up	$160.00
Qwest Office Plus DSL. 1.5 mbps down, 896k up	$ 56.25
Qwest Office Plus DSL. 5 Mbps down, 896k up	$ 73.13

Proposed New Data Products

15 Mbps symmetrical	$ 59.99
30 Mbps symmetrical	$ 99.99
100 Mbps symmetrical	$199.99

The retail model assumes that large businesses would be served on a wholesale basis. The network would only sell large data pipes to either the businesses or to the carriers that serve them. The model assumes two data products whose monthly rates are initially as follows. These prices cost more than the small business products since these data supplied on these products is shared by fewer customers.

10 Mbps Data	$ 400.00
100 Mbps Data	$1,400.00

The retail model assumes there will be no hook up charges for customers and customers will be able to switch to the fiber network at no cost. However, most fiber networks run credit checks and require deposits from customers with bad credit.

Operating Expenses

The retail model assumes that one company builds and operates the network. As a retail provider, this company would incur the normal industry expenses for operating a triple-play network. Following is a description of the major costs:

- One of the largest costs is cable programming. Today most small cable companies buy programming from NCTC, a cooperative. However, the cooperative has had a moratorium on new membership since November 2005. The model assumes that the business could either join the cooperative or would be able to buy at cooperative prices through an existing coop member. If programming is purchased a la carte it would cost 30% more than is shown in the model. However, there are alternatives growing in the marketplace that might reduce the price differential to around 15%.
- Another significant expense is labor. To be successful, this venture would need to focus on good customer service. Thus, the majority of employees are in two groups that deal with customers. The largest customer care group is customer service representatives who take orders, answer customer questions and resolve billing issues. The number of customer service reps grows as the business grows and eventually there would be 92 customer service reps for a 40% penetration. The other customer group is the help desk, which answers technical questions and takes trouble calls. The help desk would grow to 43 people at a 40% penetration.
- The remaining employees are needed to operate the back office, maintain and monitor equipment and run the network. The model assumes that installation would be done using contractors, rather than City employees. Most such networks use contractors since they don't want to lay off employees after the initial build-out is completed. Total employees would grow to 203 with a 40% penetration.
- Another significant expense is the Internet backbone. Since the company would offer robust data products it will require a very large pipe to the Internet. The model predicts the cost of Internet backbone growing to nearly $8M per year by the tenth year.
- The company would invest in modern software that would allow for efficiencies. For example, software exists today that will automatically provision the voice switch, data service and cable service. Thus, customers could see product changes immediately while talking with a customer service rep. The company also should invest in a robust billing/OSS system to create efficiencies in order taking, provisioning and billing.
- The company should have typical other operating expenses for such things as vehicles, computers, travel, training, supplies, insurance, etc.
- One significant expense is the cost of debt financing. The retail model assumes a municipal bond at an interest rate of 5.2%, which is higher than today's rates of 4.7-4.8%. A municipal bond should be able to fund 100% of the business with no required cash from the City. If the business is financed at commercial rates, the interest rate will be higher and equity will probably be required.

Network Costs

Equipment costs are the primary cost of launching this business. Network costs can be put into major categories – costs of the core network and costs to provision customers. The core fiber network consists of building fiber to every part of town and the cost of the fiber network is estimated at $194M. In a retail model the core also includes FTTH electronics, a voice switch, a data headend, and a cable TV headend and antennae to receive programming. The cost of the initial FTTH electronics in the core is around $42M. The other core assets, including a building, vehicles, computers, furniture, a switch and a headend are around $10M.

- The remaining network costs are success driven. This means that costs are only added as the network adds customers. The two primary costs to obtain a customer are fiber drops and ONTs (the electronics on the side of the home).

Following is the capital required during the first five years using the two assumed penetration rates:

	1st 5 Years	1st 10 years
30% Penetration	$345M	$444M
40% Penetration	$353M	$482M

One final note on capital - the model assumes there will be two major equipment upgrades during the first 20 years. While fiber equipment today is robust and can easily deliver 100 Mbps of data or more, improvements are expected in the future. The model assumes replacement of much of the core electronics. Customer ONTs are expected to need software upgrades or chip replacement. To the extent that two upgrades don't happen during this time period, more cash would be generated than shown in the models.

Summary of Key Assumptions

Some key assumptions in the retail study:

- The study assumes that the first retail customer can be served 18-months after receipt of financing.
- Rates are approximately 20% less than the incumbent's rates today and data speeds are assumed to be vastly faster than incumbents with lower prices. For example, initial residential data speeds might be 10-Meg, 20-Meg and 50-Meg, symmetrical. Over time the City will probably increase speeds but hold prices steady.
- Rates for telephone and data are never increased. Rates for CATV are raised 7% every second year (Comcast has been averaging 6% to 7% increases every year).
- The study assumes that telephone penetration rates will erode over the years due to VoIP and cell phone usage.
- The study uses six full-time salespeople to sell to small and medium businesses. The study also assumes that the only sales to large businesses are large data pipes – serving such businesses is too labor intensive and complicated.

- For modeling purposes the study assumes that the business will have the same product offering for 20 years. Obviously over 20 years there will be new products in the marketplace. The study assumes that the company will technologically be able to match anything offered by others, and if one revenue stream erodes, any shortfall will invariably be made up in new product lines.
- The study assumes two major asset upgrades during the first 20 years with a replacement of fiber electronics and software.
- Residential installations have been set at 2,000 customers per month. This is aggressive and will require outsourcing to contract installers. Even at that speed it may take over five years to reach a 40% market penetration.
- The company will perform its own customer service and help-desk in-house.
- The study assumes a 20-year bond with capitalized interest for two years and no principle repayment for the first two years and financing at an interest rate of 5.2%, which is slightly higher than current market rates. Commercial loans would be more expensive.
- If the City were the provider it could borrow all of the money required and should not need to make additional cash contributions unless penetration rates go higher than expected (cost of success).
- Salaries and expenses grow at inflation.
- The household growth rate is assumed at less than ½% per year per the last Census.
- The study shows no in-lieu-of-taxes on revenues or profits paid to the City, but there is sufficient net income to fund such payments to the City. Such payments would probably not begin for 5-7 years after launch until the business is solid.
- The study assumes the business will collect the same taxes from customers as the incumbent providers today.
- The study does not show any withdrawal of excess cash. Excess cash could be reinvested in the business, used to further lower rates, or used to accomplish social goals to solve the economic divide and other issues.
- The study assumes that cable programming can be obtained at the NCTC cooperative rates or find a partner to bring cheap programming rates. If not, the programming expenses would be 35% higher than in the model.
- The network is assumed to be a PON network. However, the cost of other technologies would be roughly the same.
- The engineering design saved significant network costs in two ways. First, it assumes that the existing fiber network can be used for the core. Second, it assumes that in most of the city fiber must be built only along the long length of city blocks since the short sides can be served with drops.
- The study assumed a new building is needed to house the headend.
- The study assumes that the City would be an anchor tenant on the network and that the business would take over City voice and data services after a few years of operations.

Breakeven Analysis

It is always important to understand the breakeven point for a new business. The breakeven point is where the business has enough cash to be self-sufficient and has further earned enough cash to retire the debt.

The retail model shows breakeven at a 24% residential penetration if we assume the City is the provider. This penetration level will actually generate enough revenue to repay the borrowing in a little less than 20 years, but if the penetration is any lower the business runs out of cash in years six and seven. Since the market survey showed a much higher interest in a fiber network, it should not be difficult for a retail provider to get a 24% market penetration.

Breakeven is harder to define if the provider was a commercial firm. each of which would establish its own criteria to define success. For example, a non-profit corporation would probably have almost the same breakeven as a municipal entity. However, for-profit commercial firms expect a return over and above debt payments. Thus, each commercial firm would expect some internally set goal of profits. A typical business looking for at least a 20% return on investment would achieve breakeven at around a 30% penetration.

Summary and Profitability

Following is a summary of the key findings of the retail model.

Penetration Rate	24%	30%	40%
Size of Required Bond	$455M	$468M	$478M
20-year Internal Rate of Return	9.0 %	10.8%	12.8%
Cash at end of 20 years	$129M	$270M	$488M
Bond Breakeven	18 Years	16 years	14 years
20-year customer savings	$1.9B	$2.0B	$2.1B
Year-10 investment per home passed	$1,309	$1,385	$1,501
Year-10 employees	138	157	190

As this summary shows, the amount of financing required is dependent upon the expected penetration rate. The more customers added to the network, the higher the network costs at the time of construction, but the more quickly the bond can be repaid. This is referred to as the cost of success.

Profitability is defined differently for a municipal venture and commercial firms. A municipal business generally defines ‘profits’ in terms of cash generated. If a municipal business can fully support its own costs including operating costs, capital and debt, then any excess cash is considered as profit. Municipal utilities generally roll excess cash back into the business or else give it to the general fund of the city. Municipal ventures

also often use the cash to support social goals. With this sort of network, one potential social goal might be to get broadband to every child in Seattle.

The retail business defined in this study is very profitable by municipal standards. Once customer penetration rates exceed 24%, the business generates significant excess cash. There was no particular rationale about the use of 40% as the top penetration rate and it is certainly possible for the business to significantly exceed that penetration rate, and thus generate even more cash. As the Seattle market survey indicated, penetration might be as high as 60%.

Although profitable by municipal standards, the business is only moderately profitable by commercial standards. However, a large company that already operates other similar businesses elsewhere would achieve an economy of scale and could be expected to do better than predicted in this model. Such a company would already have software systems, programming arrangements, customer service centers, etc. The business as predicted in the model is a standalone business, and it would be more efficient than shown in the model if the venture were part of a larger company.

One significant set of figures to note is the cost per home passed. Seattle is a large enough city that any network in the City achieves economy of scale. The cost per subscriber predicted by this study is lower than for any existing fiber network in the U.S. today.

The Wholesale Model

A wholesale model requires City participation. In a wholesale model, the City would build the core network and would then sell capacity to private retail providers. Capacity could be sold to retailers by leasing loops, leasing bandwidth or some combination. The City would build the identical fiber network used in the retail study, passing every home and business in the City. In this model, the City would also provide the fiber drop and customer electronics for each customer as they are added to the network.

Under a wholesale model the City would not be an anchor tenant of the network since the wholesale business would not offer voice or data services, just access to the network Our analysis shows that a wholesale network can work, but the key factor for success is the speed at which the retail providers add customers. In today's marketplace, with only a small number of potential retail providers, there is no incentives the City can offer that will ensure that the retail providers sell fast enough, thus creating a risk that the City won't be able to meet bond payments. This risk would be greatly reduced if a half dozen quality retail providers could be attracted to the network – however, this retail market does not yet exist to any practical extent in the U.S. The lack of quality retail providers is the primary flaw today with a wholesale model.

The wholesale studies were done at two market penetration rates, 30% and a 40%, both of which were eventually profitable. Again, the biggest key for success of the wholesale

model is the speed at which the retailers can add customers to the network. The model assumes that the retailers add 1,500 customers per month for a number of years. This is an aggressive assumption, and the City would run out of cash if the retailers build slower than this.

In today's environment it may not be possible to find retail providers who are willing or able to sustain such a growth rate. The biggest issue with the wholesale concept is that retailers tend to cherry pick. The wholesale model shows that the City must collect at least $40 for access to a residential customer in order to pay for the network. If a retailer pays $40 to the City, they are going to target customers that spend at least $75 per month on services, and they will want customers that spend even more than that. Thus, there is a danger that the wholesale model would create a fiber network that would be marketed only to those customers with the largest expected communications bills. Households that spend $40 or $50 per month would likely be excluded from the fiber network since no retailer would choose to serve them. If the cost to the retail providers to access customers is set lower, the City would not have enough revenue to make bond payments.

The wholesale process of selling access to the retailers creates a Catch-22 situation. The City needs the retailers to sell to many customers. However, by charging $40 per month to get to a residential customer the City ensures that the retailers will cherry pick, and not sell quickly enough. It's all a numbers game. In most markets, roughly 20% of customers buy the expensive full package of products. This rule of thumb seems to carry across most U.S. markets. A cherry picker will be aggressively pursuing this 20% of the market, and even if they do well, there will not be enough sales to sustain the network owner. The problem is that if the network can attract only one or two providers, they will most likely be cherry pickers. Today there is not a robust industry of different types of retail providers ready to come to Seattle and open up shop. If we were able to attract many providers, each with different philosophies, then the wholesale network would have a decent chance at success. But since there is a paucity of retail providers, the wholesale model looks to be very risky for the City since there is a high risk that the retailers won't add customers quickly enough to guarantee financial success for the City.

Revenues

In the wholesale model the City sells access to retail providers to reach customers on the fiber network in the form of loops or of bandwidth. The charges to various retailers will be negotiated and will vary with quantity discounts for retailers who add large numbers of customers to the network.
The model assumes average chargers per wholesale end-user customer as follows:

Residential Customer	$ 40 per month
Small Business Customer	$ 75 per month
Large Business Customer	$150 per month

Again, these rates create a Cath-22. In the long run we know these rates need to be no higher than $30 for a residential fiber connection. Rates any higher than that will lead to

cherry picking. However, if we set the rate at $30, then there is no realistic model where the retailers can sell fast enough for the City to make bond payments. It's possible that there is an alternate financing mechanism, maybe a series of bonds, that could stagger payments and help offset this problem. But in looking at normal municipal bonds, I could find no realistic scenario that would create enough revenue for the City in the early years. These wholesale models eventually become profitable, even at a $30 loop charge. However, such a model requires a number of years of subsidies to make it work.

Additionally, the model anticipates that the City would be charging non-recurring revenues to the retail providers for hooking up each new customer. The model assumes that the one-time fees are 3.5 times the monthly access fees. This up-front payment helps to offset the cost of the fiber loop.

Finally, the network provider would get some revenues from selling co-location space and connectivity to the retail providers. The model assumes that each retail provider would be billed $5,000 per month as a generic connection fee. This sort of fee would make certain that any retailer that signed up for the network would be serious about selling into the market place. It would be too costly for the City to allow retailers on the network that might only have a handful of customers.

Operating Expenses

The physical wholesale fiber network is essentially the same as the retail network. The network still places fiber near every home and business in the City and would still build a fiber loop and place an ONT for any customer added to the network. The City would not directly offer any retail services, however, so there would be no voice switch, data headend or cable TV head end.

The City would still need employees to operate and maintain the network, but there would no longer be a need for customer service reps or help desk for the public. The wholesale business requires some employees to take daily loop orders from the retailers and only one salesperson to negotiate contracts with the handful of retail providers. The wholesale business needs just over 30 employees to operate the wholesale network, instead of the hundreds required in the retail model.

The wholesale network also no longer has to buy programming or connect to the Internet. Those costs are borne directly by the retail providers.

Essentially the costs of operating a wholesale network are the manpower needed to maintain the network and the normal costs of operating and maintaining a fiber network.

One issue with operating a wholesale network is the cost of debt. Wholesale network produces what the IRS calls private use revenues, meaning it is taxable. The revenues are private use, because the products we sell on the wholesale network – access to customers – is then packaged into other bundles of products by the resellers and sold for a higher price. This means that a bond for a wholesale network has to be a taxable bond. In

today's environment, the interest rate differential between taxable and tax-free bonds is about 1%. However, historically the difference has been closer to 1.5%. In our study we used the same interest rate for both the retail and wholesale models, to make them more easily comparable. However, the 5.2% rate used in these studies is higher than the rate available for tax-free bonds like would be used in the retail model, and is lower than the taxable bond rate that would be used in the wholesale model.

Breakeven Analysis

The wholesale model requires an overall market penetration of just under 30% in order for the City to have enough cash to make bond payments. However, as mentioned earlier, overall penetration alone is not a sufficient indicator of success. It also matters that the retailers get sufficient customer during the first few years to help pay for the network. Thus, the key to breakeven is a 30% overall market penetration achieved quickly enough to create cash flow for the City.

As mentioned, the rate of the loops is also key. If the loop prices are too high the City will be promoting cherry picking. If the loop rates are too low, even high sales volumes may no produce enough cash to make bond payments. Any wholesale model has a lot of risk for the network provider.

Summary of Assumptions in the Wholesale Study

Some key assumptions in the wholesale study:

- The study assumes the City builds the fiber network and is responsible for fiber drops and ONTs.
- The retailers provide the assets needed to supply telephone, cable TV and Internet services. The retailers also supplies set top boxes, modems or other customer devices.
- The City sells access to the network to retail providers. These providers might be CLECs, cable providers, ISPs or other companies wanting access to customers through the fiber network.
- The model assumes that retail customers can be on line 18-months after the City receives financing.
- The City staffs to operate the network with projected 33 full-time employees.
- The retailers need to collectively sell 1,500 customers per month in order for this venture to be successful for the City. Slower growth creates cash shortfalls for the City.
- Financing is done using a 2-year construction loan followed by a 20-year bond with capitalized interest for one year and no principle repayment for the first year. The model assumes financing done by bond with a rate of 5.2%, which is slightly higher than current market rates of 4.5%-4.7%. The construction loan is needed to extend the period for which the bond can pay for capital. There is a risk that bond rates will be higher if/when this project seeks financing on the bond market.

- The City can borrow all of the money required and should not need additional cash unless the retailers sell slower than expected.
- Salaries and expenses grow at inflation.
- Household growth rate is assumed at less than ½% per year per last Census.
- The model does not show any withdrawal of excess cash. Excess cash could be reinvested in the business, or used to further lower rates.
- The network was designed with PON technology. However, the cost of alternate technologies is roughly the same.

Summary and Profitability

Following is a summary of the key findings of the wholesale model.

Take Rate	30%	40%
Size of Required Bond	$459M	$459M
20-year Internal Rate of Return	6.4%	8.5%
Cash at end of 20 years	$7M	$156M
Bond Breakeven	20 years	18 years
Year-10 employees	33	33

The first fact to note is that the size of the wholesale bond is nearly as high as the retail bond, but with greater risk. The high cost of the wholesale network is due to several issues: first, the same fiber network must be built. Secondly, there is less revenue to offset the cost of construction. Finally, the cost of financing the wholesale model is higher.

The wholesale model will cover bond costs if the retailers sell to enough end-user customers. The wholesale model eventually generates excess cash for the City, but this cash comes near to the end of the bond cycle.

One of the biggest concerns with a wholesale model is that there is no mature set of retailers in the U.S. waiting to provide services over this type of open access network. There is a budding retail market in Europe, but the only open access network in this country is in Provo, Utah and they have attracted only one service provider. The eventual vision for an open access network would be to have dozens of service providers offering a wide array of different services. Such a network would be high in innovation and have enough competition to keep prices very competitive. The wholesale concept loses much of its appeal to the City if there are only a few retail providers. If the handful of providers fails, then the City fails. It would be particularly troublesome to rely on retail providers that are trying this economic model for the first time. There is little downside to such a company abandoning the market, but a huge downside for the City.

Comparing the Retail and Wholesale Models

Cost to Build

From a borrowing perspective it costs nearly the same to build a retail or wholesale network. Both networks require the identical fiber network.

For an expected 30% penetration, the bond needed for the retail network is $468M and the wholesale network bond is $459M. the small difference in price reflects the savings from not buying equipment like a voice switch and a CATV headend – otherwise the network costs are identical.

Profitability / Cash Generation

Both models will satisfy a municipal definition of profitability – that is, both a retail and wholesale model ought to generate sufficient cash over 20 years to pay for operating expenses, pay for debt and fund needed capital upgrades. However, from a commercial perspective, the retail model is far more profitable than the wholesale model. At a 30% market share the retail model would generate $270M in excess cash over 20 years while the wholesale model would generate only $7M. At a 40% market penetration the retail model would generate $488M while the wholesale model would generate $156M in excess cash. Given the high numbers of the market survey, it is possible that a City system's market share could be even higher, thereby widening the gap in profitability of the retail system.

While the profitability on the retail model is modest by commercial standards, it still might be possible to attract a private firm to build and operate the network. However, during the RFI process the City did not identify a commercial firm willing to commit to building a fiber network in Seattle.

Public Benefits

The discount on prices that could be offered to customers would be greater with a retail model. If the City were the primary service provider, the feasibility study suggests that the City could offer across-the-board 20% discounts on all telecommunications services. The FCC reports that in competitive markets today, cable rates average 17% less than surrounding communities without competition. The experience with CLECs around the country is that they offer around a 15% discount compared to the incumbents. Thus, the overall discount under the wholesale model ought to be around 15% to 17%. This is still a good discount, but not as good as what the City could offer. Further, if the City ran the business like a utility, over the years excess cash could be used to further reduce rates. Note that the retail model assumes a cable rate increase of 7% every second year, while Comcast has been historically raising rates nearly 7% per year. Under a retail model the discounts ought to increase over the years.

One of the most significant reasons to build this network is customer savings. If the network cuts rates by 20% and the incumbents lower rates by 10% to stay competitive, the savings over 20 years is around $2 Billion for consumers in the City. That money would be a gigantic boost to the local economy.

If the City is the retail provider, it could make high bandwidth a goal of the network. Currently, large commercial providers restrict large bandwidth. Verizon offers residential products on its fiber network of 5 Mbps, 15 Mbps and 30 Mbps, although their network is capable of greater speeds. Additionally, Verizon's products offer far faster download speeds than upload speeds. In a wholesale environment one might expect the same sort of behavior from the retail providers. Large companies view their bandwidth as a scarce resource and don't think consumers 'need' big bandwidth and tend to keep bandwidth low unless they face competition over speed.

If the City were the retail provider, however, it could offer the largest bandwidth products possible., with upload and download speeds much faster than the competition. Over time the City would probably have the goal of increasing speeds even more as its costs decreased or as technology improves. A whole paper could be written about the benefits of greater speeds, but the short version of the story is that greater data speeds will promote innovation and make Seattle cutting edge in the world economy. Seattle's competition in Japan and Korea are building 100 Mbps networks today.

In the long run a wholesale model probably will bring more innovation to the City than if there were only one provider on the network. Since there is no robust industry of retailers ready to bring service to a wholesale network, however, the City will initially be hard pressed to find more than one or two providers for a wholesale network. One can envision where the old Qwest commercial finally comes to fruition, with Seattle having a network that can offer "every program every made, delivered at any time". The fiber network would support such a technology, but these kinds of content providers do not yet exist.

Benefits to the City

If the City entered the retail business, it could essentially get City telecommunications services for free, or at least at a tiny incremental cost. While a City broadband business would probably still render a bill to other branches of the government, payments from one branch to another eliminate upon consolidation.

A City-run network would also ensure that the City gets the best data speeds and the best technology. A City-operated network would also connect all City locations together, including small and remote locations.

Probably the largest benefit to the City of operating a retail network is the possibility of generating significant new cash for the City. Such a business could be operated as a utility, and as such could generate cash to the City as is done today by City Light. Cash could also be generated by such a business through taxes. Many other municipal utilities

pay 'in-lieu-of-taxes' from revenues generated. Since the retail network generates far more cash than a wholesale network, the opportunity for income for the City is far greater with a retail network.

Social Goals

The retail network, if operated by the City, has the opportunity to promote a number of social goals. These goals would be difficult to pursue with the wholesale model. Some of the more important possible goals the City could pursue:

Net Neutrality. The largest carriers are trying to implement a scheme whereby they will charge Internet content providers to get 'priority' deliver of signal. If these carriers can implement this idea they will have vastly changed the Internet. Only the largest players like Yahoo and Google will be able or willing to pay for speed, and new companies, organizations, and individuals would have a difficult time gaining real access on the web. A City network could maintain Net Neutrality as it exists today, thus bringing the best innovation to Seattle. We think most Seattle customers would value a network that kept network neutrality.

Solve the Digital Divide. If the City operates a retail network it could use excess cash to help subsidize high speed Internet for any home that needs it. Seattle could become one of the first cities where every child has equal access to the Internet and all the benefits this will bring. Note that even with a retail model this will not be possible on day one, but once sufficient cash is generated this could become a top priority.

Make Bandwidth a Priority. As mentioned above, the City could make high bandwidth a priority. Other providers are more likely to offer just enough bandwidth to be just a little better than the incumbent competition. The City as a provider can make Seattle competitive with the rest of the world.

Economic Development. With a retail network that goes to every home and business, the City will be in a position to spur economic development for firms who care about bandwidth. With fiber everywhere the City can be very creative and can offer solutions and prices not currently available anywhere else. As Verizon begins to offer its high speed FiOS network to Seattle's neighboring suburbs, a City network would be essential to keep Seattle competitive.

Hybrid Model

CCG also looked at a hybrid model in which the City is the sole initial retail provider. The City has exclusive use of the network for seven years, creating an opportunity to capture a significant amount of market share and to generate enough revenues to ensure successful repayment of bonds. At the end of seven years, or whenever certain financial parameters were met, the network would be opened to other competitors.

This model takes the best from both the retail and wholesale concept. It uses the profitability component of the retail model to make sure that bond obligations can be met. It also opens up the network to full competition, thus allowing for innovation and serious price competition. In addition, it keeps the City in the retail business so that social goals can be pursued.

This model avoids the pitfalls of the wholesale model, and yet ends up with the same open access competition. The wholesale model's biggest problem is that there is no robust market today of retailers ready to compete on an open access network. With only a handful of competitors, it is very unlikely that customers will be added quickly enough to satisfy the City's bond obligations. Further, under a pure wholesale network the City must charge a high fee of at least $40 per month for providers to get access to a residential customer. This price will tend to cause providers to cherry-pick and serve only those customers with large monthly bills. Further, cherry picking will ensure a small market penetration since providers will concentrate only on the premium customers.

The hybrid model avoids the additional pitfalls of the wholesale model of inadequate incentive to speedily add customers. As the initial retail provider, the City can aggressively seek retail customers. The market surveys predict a tremendous interest in a City fiber network among Seattle households. The City could easily get to the penetration needed for breakeven, meaning that bond payments were assured. The City also can control the speed at which customers are added to the network.

One would hope that in the seven or so years when the City opens the network to competition that there will be more retail providers interested. Interestingly, with the hybrid model the City would no longer need to charge $40 for wholesale access to a residential customer. The model suggests that the access fee in five to seven years could be closer to $25 per month. This rate can be lower since the City will have already generated a big enough retail revenue stream to make bond payments, thus allowing the lowering of wholesale rates. While a rate that low still may not stop retailers from cherry picking, it gives a retailer the opportunity to be profitable with customers who have smaller monthly bills. Finally, under the hybrid model the City stays in the retail market, competing against other providers. As such the City will have the opportunity to use profits to pursue social goals such as solving the digital divide.

From a financial perspective, the hybrid model costs nearly as much to start as the retail model. In the long run the hybrid model will make more money than the wholesale model but less money than the retail model. A comparison of the three models at a 40% penetration is as follows:

	Retail Model	Wholesale Model	Hybrid Model
Size of Required Bond	$478M	$459M	$473M
20-year Internal Rate of Return	12.8%	8.5%	12.4%
Cash at end of 20 years	$488M	$156M	$427M
Bond Breakeven	14 years	18 years	14 years
Year-10 employees	190	33	161

Major Findings

Following are some of the major findings generated by the feasibility studies:

- A single retail provider can be successful in Seattle. Such a provider could finance, build and operate a fiber network profitably. If the City or a non-profit company were the retail provider they could give a 20% discount over today's market prices and still break even with as little as a 24% market penetration. A commercial firm probably needs a 30% penetration to be successful. Higher penetrations generate significantly higher profits and more cash.
- The City could be successful with a wholesale model. In this model the City would build the network and sell access to the network to large service providers. A wholesale model would achieve breakeven at around a 30% market penetration of retail customers. However, it is important that the retailers sell significant numbers of customers in the first few years or the wholesale business would run out of cash. Thus, the wholesale model carries a large amount of risk.
- Possibly the best scenario is for the City to begin as a retail provider and then open the network to other competition on a wholesale basis. The study called this the hybrid option. The hybrid option avoids the pitfalls of the wholesale model and yet also gets the best benefits of an open access network over time.
- The cost of creating a wholesale or retail business will require a financing of over $400M. There are few savings to create a wholesale business rather than a retail business.

Potential Financing Mechanisms

The City should be able to borrow money for either a retail or wholesale venture with traditional municipal bonds.

For the retail model the study contemplated a 20-year bond. The bond had an interest rate of 5.2%, slightly higher than today's market rate. The bond had capitalized interest for the first two years.

A wholesale model would require more creative financing because it is anticipated that the retailers in a wholesale model would not build to customers as quickly as a single

retail provider. This means that the capital needed to add customers would stretch beyond the normal five-year period allowed by law for bonds. The financing method that looks to work best for a wholesale model would be to obtain a two year temporary construction loan followed by a 20-year traditional bond. Both parts of the loan package could be negotiated together upfront. However, delaying the bond for two years while the project comes on line always introduces the risk of interest rate increases when the bond is finally marketed.

There are other options to consider with financing. It's possible that the retail or hybrid option could be funded with a standalone revenue bond. Such a bond would rely solely upon the revenues of the telecom venture and would not require the pledge of any other City revenues. A standalone bond would demand a slightly higher interest rate, although today they are at attractive rates of 4.7%- 4.5%, but would eliminate financial risk for the City. Since the revenues and margins are smaller in a wholesale model, it looks as if getting a standalone bond for wholesale is unlikely.

It is also possible to finance the retail or hybrid model with a standard municipal bond and buy bond insurance to guarantee the payments. Such insurance is expensive, however, and effectively is the same as paying a higher interest rate. However, some level of insurance would reduce the City's risk.

In today's market, commercial interest rates are significantly higher than municipal bond interest rates. Although it is possible this venture could be financed with a commercial loan, such loans generally have more stringent loan covenants than municipal bonds. Commercial loans seem to be the least attractive option.

On the other hand, if some commercial enterprise were to build the network there would be zero risk for the City. We did not identify any such an entity during the RFI process, but the positive results found by this study may he sufficient to attract a commercial partner going forward. The commercial returns on this venture look to be okay, but not spectacular, which probably explains why we didn't attract a serious operator during the RFI process.

Risks

In terms of risk, there will be less risk to the City to create a retail network or a hybrid network rather than a wholesale network. The feasibility study shows that a retail or hybrid business plan can pay for itself with as little as a 24% market penetration. Based on the results of the market survey, with significantly higher market penetration, such a target should be readily achievable.

A wholesale network can pay for itself with something around a 30% market penetration. However, with the wholesale model it is essential that the retailers bring customers to the network quickly. If they don't sell fast enough, the City would not have sufficient cash to make bond payments. Since there is chance the retailers will engage in cherry picking

and limited marketing, there is significant risk of cash shortfalls under the wholesale model.

Customers must also be brought on board quickly with the retail model, but in this situation the City would control the whole process. With a retail model there are a number of steps the City can take to bring on retail customers early, whereas the City has no control of sales in a wholesale environment. For example, the City could sign-up people during the construction period and it's a reasonable goal for the City to have signed-up enough customers during the first year or two to guarantee financial success. The market survey of residential customers indicated that the potential market for a retail network is very strong.

One way to avoid the risks of the wholesale model but still gain the benefits of an open access network would be to pursue the hybrid model. This option has the City starting as a retail provider until it has generated a large enough market share to ensure that bond payments can be made. At that point the network would be opened to competition, getting all of the benefits of a wholesale network, but with far less financial risk.

There is another option that could reduce risk for building the network. Several other cities today are considering standalone revenue bonds for communications ventures. This means that any bonds raised for this venture would not be backed by other city revenues, but would be backed only by telecommunications revenues. Such bonds demand a slightly higher interest rate in today's market, but the large underwriters have expressed interest in these sorts of bonds.

Finally, risk can be mitigated in some cases with bond insurance. Such insurance is expensive, but effectively reduces the risk to the City of a default. Effectively, however, getting bond insurance is like paying a higher standalone interest rate.

Recommendations

After carefully analyzing the financial results of the various studies, and when also considering other goals such as meeting social goals, CCG makes the following recommendations.

First, the best outcome for the City would be if a commercial retail provider made the investment to build the fiber network and offered a full array of services over the network. Although no such player emerged during the RFI process, now that we have the market survey and financial results that can be shared with providers a second attempt might well yield different results. The City should consider issuing an RFP that would include the results of the financial analysis and market survey. These analyses show that a commercial provider could make an acceptable profit in the City.

Second, a retail model where the City is the retail provider looks to be the best way to guarantee that there will be sufficient revenues generated to make bond payments.

However, an open access wholesale network looks to be the best long-run network for the City since multiple service providers will maximize innovation and competition. Thus, CCG recommends the hybrid approach in which the City builds the fiber network, and then the City or some corporation is granted the exclusive right to operate the network for a period of five to seven years until such time that the network has sufficient revenues to guarantee bond payments. At this point the network should be opened up to multiple providers as an open access network. The initial service provider would continue to for customers, but with a host of new retail providers.

Today there are no strong retail players ready to step in and serve customers on the fiber network. If the City were to start a wholesale model with the wrong retail partners it could be a financial disaster. There is very little cost for a retail provider to walk away from the network, but the City must make bond payments, even under a standalone financing, or face a lot of political pressure. In a hybrid model, however, if the City stays in the business as a retail provider, it can still pursue the various social goals such as economic development and solving the digital divide. Any commercial network is unlikely to seriously pursue these sorts of goals.

Recapping our study, CCG believes that the hybrid model maximizes benefits to the City, its residents, businesses and institutions. Under the hybrid model, the City could obtain sufficient profits to ensure retiring its debt, and over time provide an open network that can further stimulate innovation and competition.

Third, to the extent that bonds are used to finance this project, the use of revenue bonds would drastically reduce any financial risk for the City. Revenue bonds would pledge only the revenues from the fiber network to the bond, with no additional backing of other City revenues or tax revenues. We should also note that the interest rate on revenue bonds today can be obtained in the range of 4.7%, which is lower than the interest rate of 5.2% used in the feasibility study. In addition, the spread between revenue bonds and general obligation bonds is currently as close as it's been in memorable history.